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# PATENT SPECIFICATION

NO DRAWINGS

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920,446



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## COMPLETE SPECIFICATION

### Improvements in or relating to Cementitious Compositions

We, INTERNATIONAL SPEED-GRETE RESEARCH CORPORATION, an American Corporation of 3345 N.E. 32nd Street, Fort Lauderdale, Florida, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cementitious compositions and particularly to quick-setting compositions for use in underwater masonry structures.

In the construction of underwater structures, as well as the maintenance thereof, cementitious compositions must possess a number of properties in order to be of maximum utility. In addition to having strength after setting, the composition must provide a structure which is highly resistant to wave impact and to substantial water pressure.

Accordingly, an object of this invention is to provide a cementitious composition which is quick setting; which shows a progressive increase in strength after initial set; which is highly resistant to attrition induced by contact with flowing water; which will bond readily to other surfaces under or exposed to water; and which is not liable to check or crack while setting.

Another object of this invention is to provide a quick setting cementitious composition for underwater use wherein the proportion of ingredients may be varied over given ranges in order to provide, in the end product, selected properties such as high ultimate strength and resistance to attrition.

A quick setting cementitious composition according to the present invention comprises a mixture, in parts by volume, of 30 to 70 parts Portland cement, 10 to 36 parts calcium sulphate and 20 to 45 parts kaolin.

This mixture may have added thereto at the time of actual use sand in the proportions

by volume from 0% to 43% of sand and from 57% to 100% of the said mixture. Preferably, the proportion by volume of sand is from 33% to 43% and of the said mixture from 57% to 67%. The smaller proportion of sand is used when exceptionally high resistance attrition is required. The resultant composition is combined with water to produce a final aggregate in which the water may amount to 20% to 30% by volume.

The ingredients of the composition are thoroughly and intimately mixed together as by means of a rotary mixer or other mixing devices known in the art. Thus, to form one composition having a number of desirable properties when used as a filling or repair means for cracks or breaks in precast concrete sea walls and pilings as well as other structures as referred to hereinafter, these may be 39% Portland cement, 36% calcium sulphate and 25% kaolin in these proportions by volume.

An aggregate comprising a cementitious composition according to the present invention is fast-setting, with the initial set, in the instance described, being completed in about 5 minutes. Accordingly, in the form described, the mixing of the ingredients, delivery of the mixture to the place of use and the application thereof must all be completed within said 5 minute period.

It has been found that the mixed ingredients may be conveniently formed into balls of about five inches in diameter and dropped into the water from a point about ten feet above the water level, the balls being picked up by a diver below the water level and quickly applied to cracks or breaks in the structures which are to be repaired.

The applied material bonds firmly and quickly to the masonry or metal surfaces and provides an effective seal even with high water pressures applied to the seal. The composition

then continues to increase the strength reaching substantial ultimate strength values.

Where seals or repairs are to be made on masonry structures exposed to fast flowing waters and strong wave action, sand may be materially reduced as an ingredient of the mixture, and where conditions are extremely rugged, the sand may be omitted.

The proportion of water used in the mixture is such as to obtain what is known as an O or zero slump when subjected to the conventional slump test. In such test, as is well known, the mix to be tested is rodded into a cylinder in a vertical position. When the cylinder is lifted off vertically, the slump of the column of mix is measured in inches. While, as indicated, a zero slump is preferred, it has been found that a softer mix may be made with increased proportions of water, yet the composition will not slough off on being subjected to contact with running water.

Where the conditions of use are such that maximum resistance to attrition is desired, the composition may be formulated from a mixture of 30 parts Portland cement, 45 parts kaolin and 25 parts anhydrous calcium sulphate, all by volume.

If high ultimate strength in combination with a reasonable resistance to attrition is desired, the composition may be made of a mixture of 70 parts of Portland cement, 20 parts kaolin and 10 parts anhydrous calcium sulphate, all by volume.

It has been found that with compositions according to the instant invention, seals and repairs made with such material are highly resistant to attrition by wave action and to water pressure, even during the setting period thus facilitating repair and sealing of sea walls and the like. Since the composition does not check or crack during the initial setting period, leakage and other deleterious affects are avoided.

A composition according to this invention may also be used for effecting emergency repairs to seagoing vessels and to seal sunken ships in order that they may be salvaged. For example, holes in a steel ship, below the water line, may be plugged by applying a ball of the aggregate which is slightly larger than the hole, so as to seal the edges. The material is held in place until it sets, generally well within a five minute period. The material

may be applied from either within the ship against the water pressure or from the water side of the ship. In a sunken vessel, the sealing of all orifices is easily accomplished with the above composition. Thereafter, the ship may be raised by conventional air displacement methods. It is further to be noted that "underwater structures" include other types of structures normally found in watery environments such as dams, underwater tubes, sewers and the like.

#### WHAT WE CLAIM IS:—

1. A quick setting cementitious composition for underwater use, comprising a mixture in parts by volume of 30 to 70 parts Portland cement, 10 to 36 parts calcium sulphate and 20 to 45 parts kaolin.

2. A quick setting cementitious composition as claimed in Claim 1, comprising, by volume, from 0% to 43% of sand and from 57% to 100% of the said mixture.

3. A quick setting cementitious composition as claimed in Claim 2, comprising, by volume from 33% to 43% of sand and from 57% to 67% of the said mixture.

4. A quick setting cementitious composition as claimed in Claim 1, in which the ingredients are present in the mixture in the proportion by volume of 39% Portland cement, 36% calcium sulphate and 25% kaolin.

5. A quick setting cementitious composition as claimed in Claim 1, in which the ingredients are present in the mixture in parts by volume of 70 parts Portland cement, 10 parts calcium sulphate and 20 parts kaolin, said composition having high ultimate strength.

6. A quick setting cementitious composition as claimed in Claim 1, in which the ingredients are present in the mixture in parts by volume of 30 parts Portland cement, 25 parts calcium sulphate and 45 parts kaolin, said composition showing high resistance to attrition by water.

7. A quick setting cementitious composition for underwater use as claimed in Claim 1 and substantially as described herein.

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## ERRATA

SPECIFICATION No. 920,446

Page 1, line 1, for "GRETE" read "CRETE"  
Page 2, line 86, for "inredients" read "ingre-  
dients"

THE PATENT OFFICE  
30th August 1963